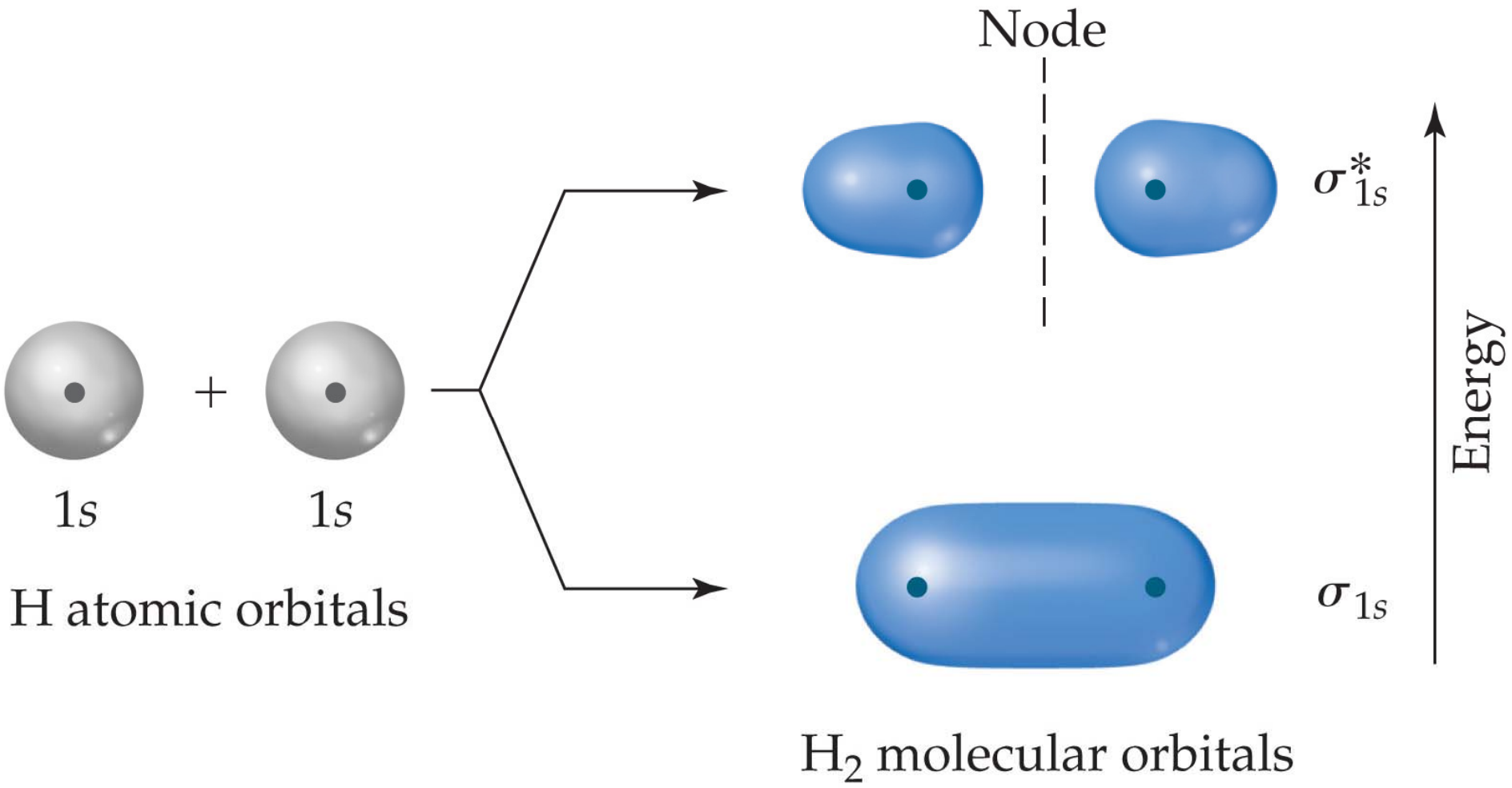
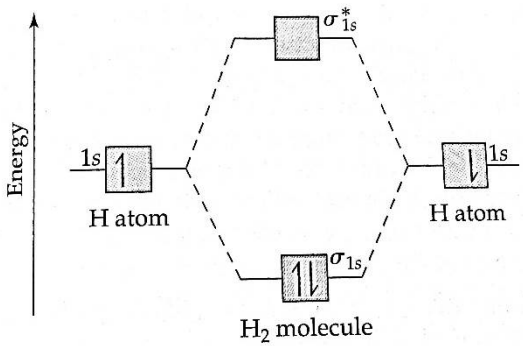
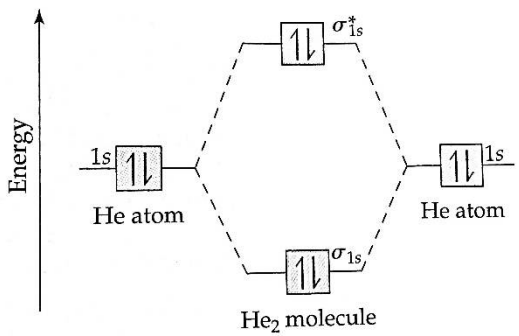


H_2



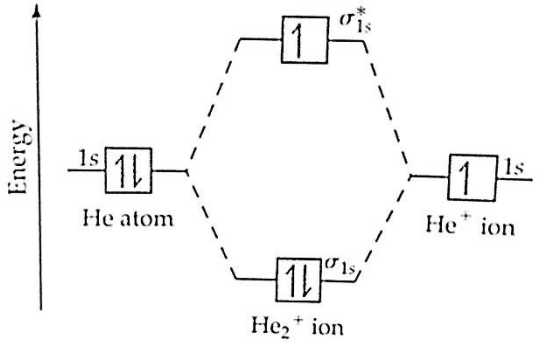
B.O = 1
Stable
Electron Configuration:
σ_{1s}^2

He_2



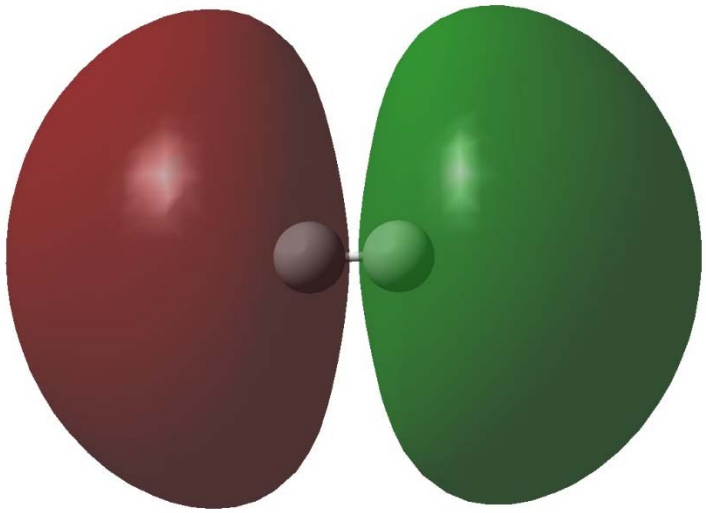
B.O = 0
Not Stable
Electron Configuration:
$\sigma_{1s}^2 \sigma^*_{1s}^2$

He_2^+

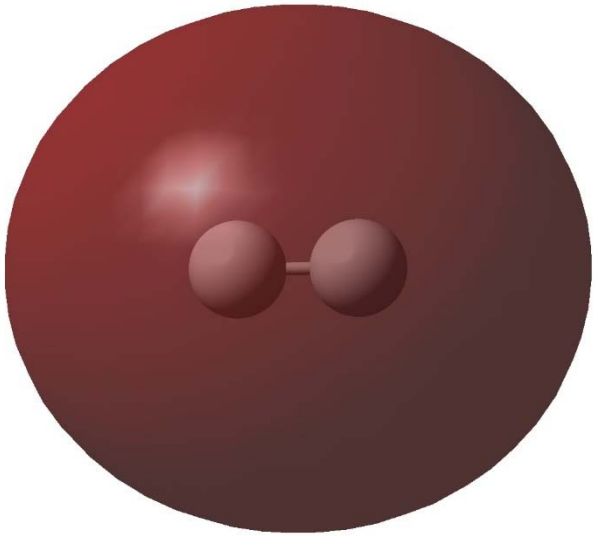


B.O = 0.5
Stable
Electron Configuration:
$\sigma_{1s}^2 \sigma^*_{1s}^1$

Bond Order = ½ (# bonding e^- - #antibonding e^-)

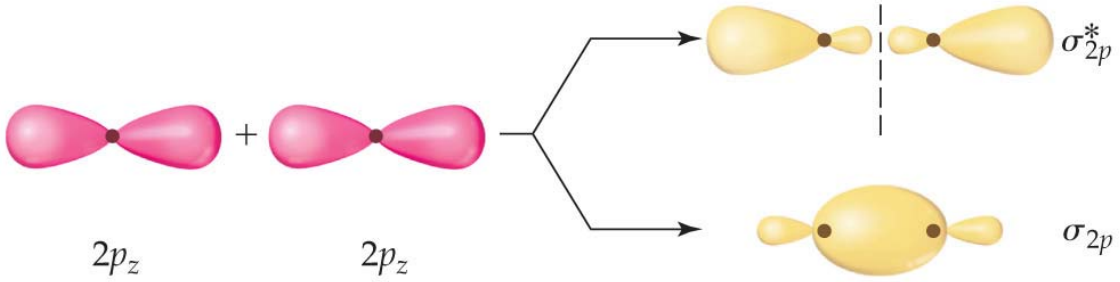


σ^*_{1s}

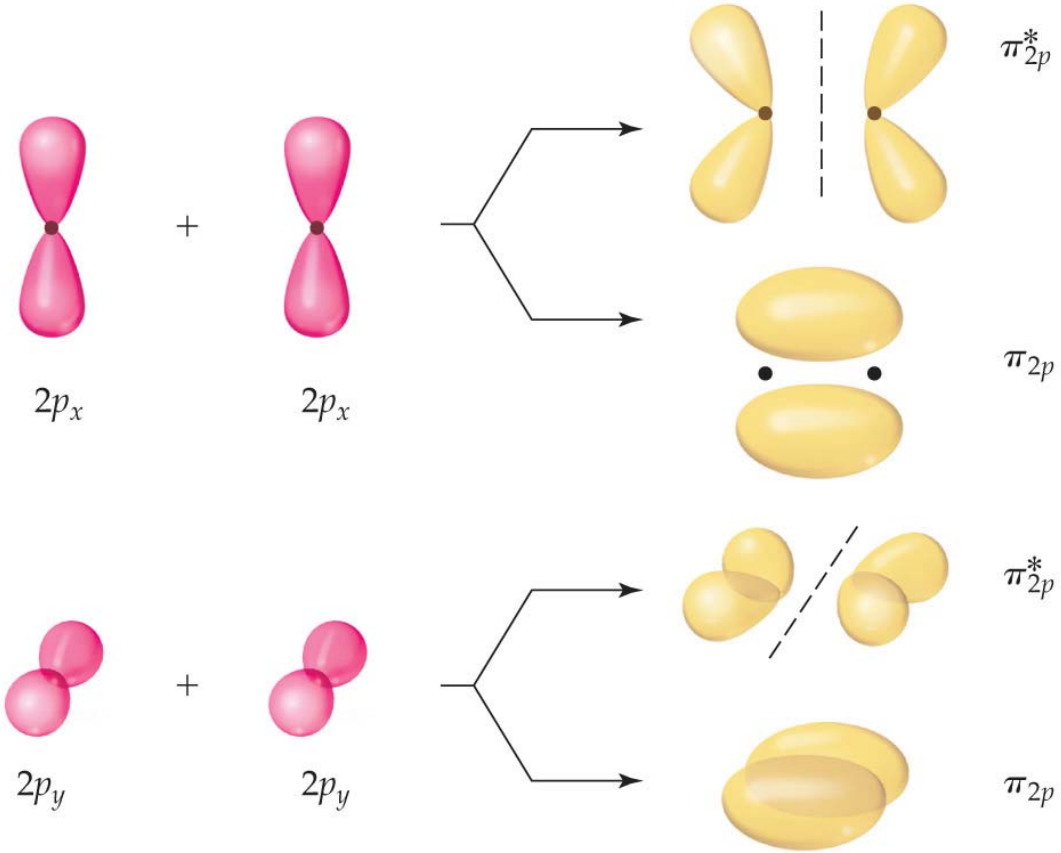


σ_{1s}

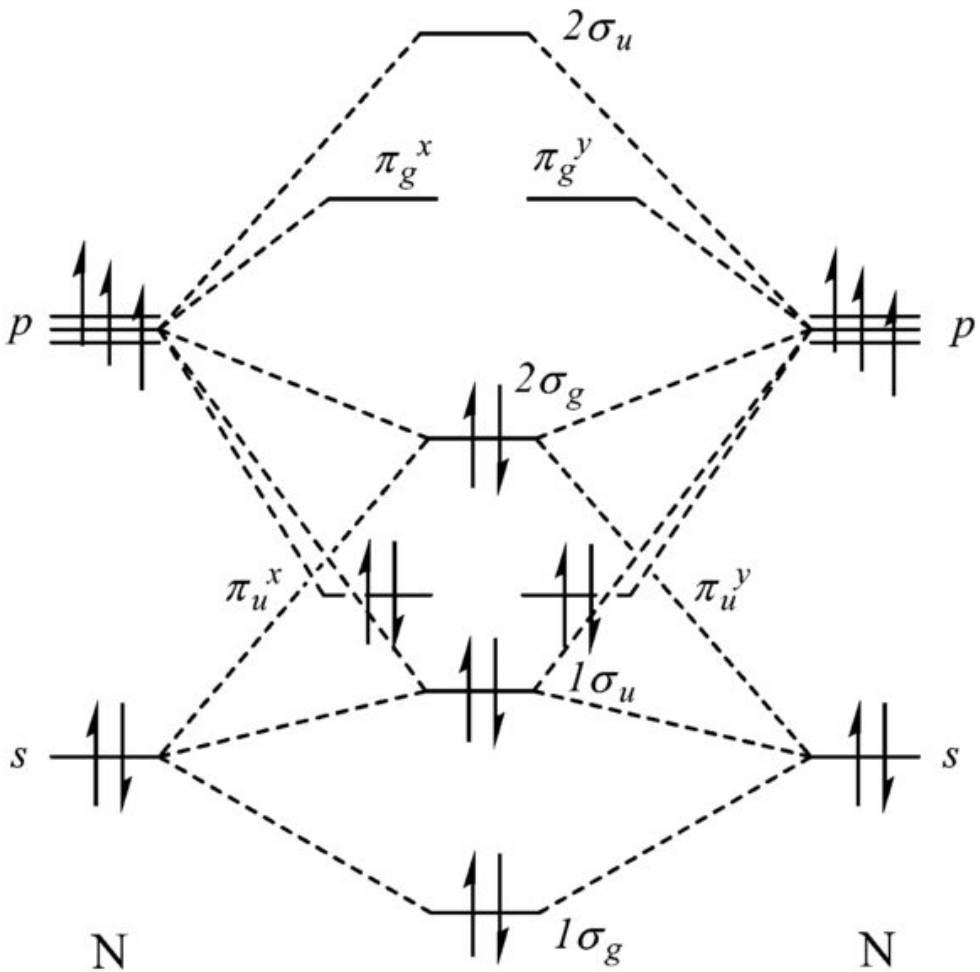
(a) "End-on" overlap of p orbitals forms σ and σ^* MOs.



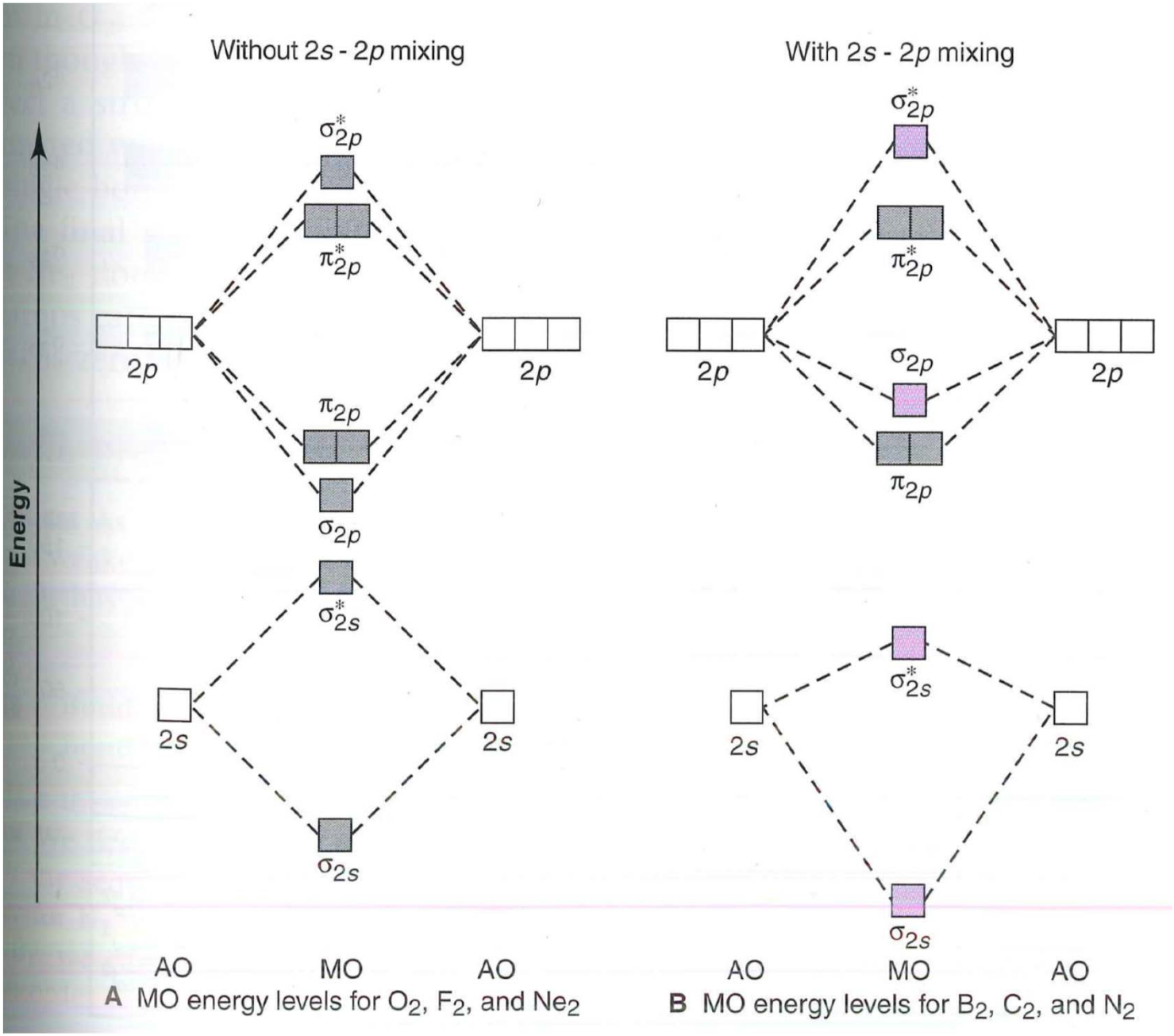
(b) "Sideways" overlap of p orbitals forms two sets of π and π^* MOs.

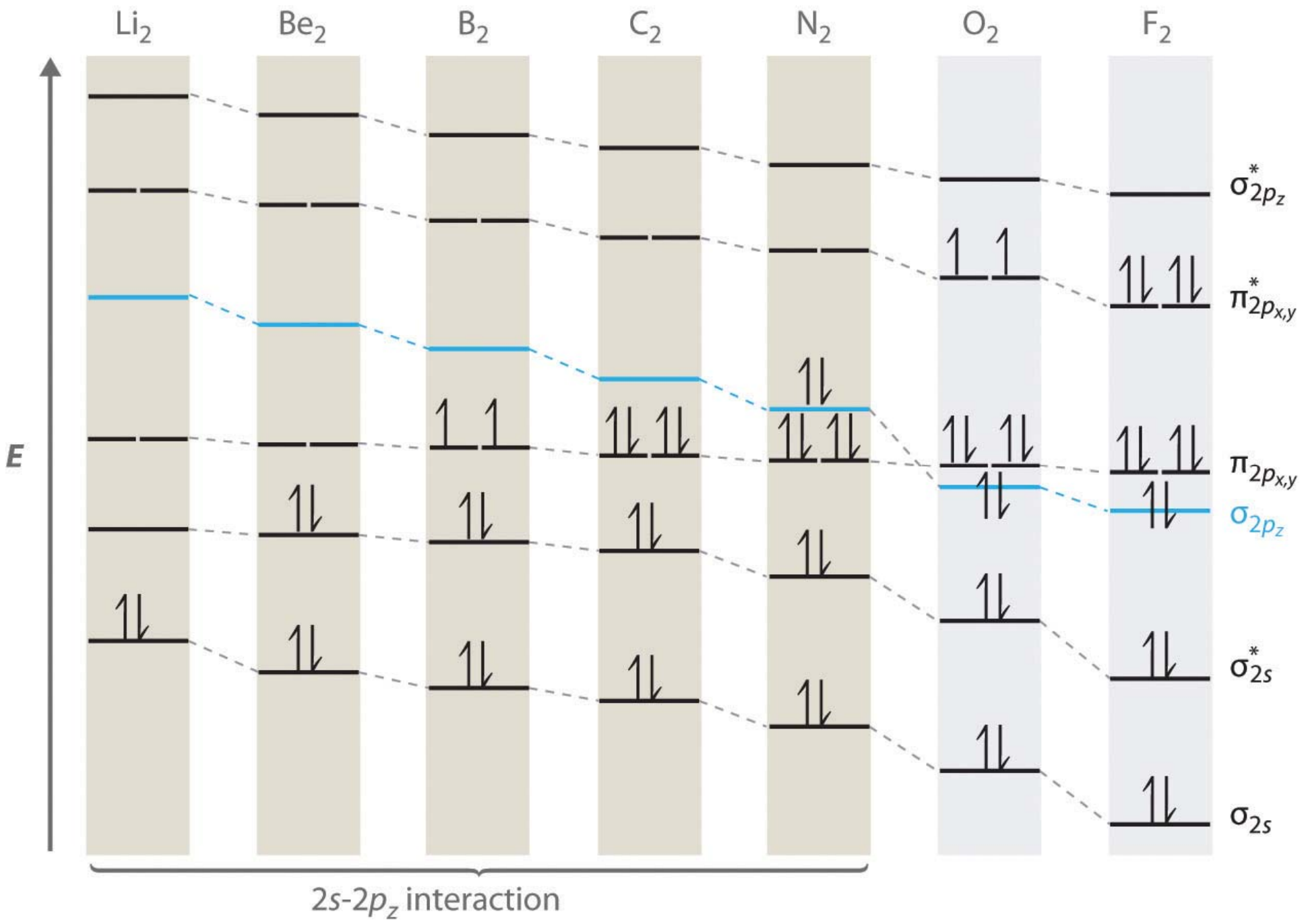


	Large 2*s*-2*p* interaction			Small 2*s*-2*p* interaction		
	B_2	C_2	N_2	O_2	F_2	Ne_2
σ^*_{2p}						↿⇂
π^*_{2p}				↑ ↑	↿⇂ ↿⇂	↿⇂ ↿⇂
σ_{2p}			↿⇂	↿⇂ ↿⇂	↿⇂ ↿⇂	↿⇂ ↿⇂
π_{2p}	↑ ↑	↿⇂ ↿⇂	↿⇂ ↿⇂	↿⇂	↿⇂	↿⇂
σ^*_{2s}	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂
σ_{2s}	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂	↿⇂
Bond order	1	2	3	2	1	0
Bond enthalpy (kJ/mol)	290	620	941	495	155	—
Bond length (Å)	1.59	1.31	1.10	1.21	1.43	—
Magnetic behavior	Paramagnetic	Diamagnetic	Diamagnetic	Paramagnetic	Diamagnetic	—


$2\sigma_u$
π_g^x
π_g^y
p
p
$2\sigma_g$
π_u^x
π_u^y
$1\sigma_u$
s
s
$1\sigma_g$
N
N

N_2


Without 2s - 2p mixing
With 2s - 2p mixing
Energy
σ^*_{2p}
π^*_{2p}
2p
2p
π_{2p}
σ_{2p}
σ^*_{2s}
2s
2s
σ_{2s}
AO
MO
AO
A MO energy levels for O_2, F_2, and Ne_2
B MO energy levels for B_2, C_2, and N_2


Li2
Be2
B2
C2
N2
O2
F2
E
σ*2pz
π*2px,y
π2px,y
σ2pz
σ*2s
σ2s
2s-2pz interaction